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Extensions of Carlitz-McConnel theorem on permutations over finite fields

Let p be a prime, $q = p^n$, and $D \subset \mathbb{F}_q^*$. A celebrated result of Carlitz-McConnel states that if D is a proper subgroup of \mathbb{F}_q^* , and $f : \mathbb{F}_q \rightarrow \mathbb{F}_q$ is a function such that $(f(x) - f(y))/(x - y) \in D$ whenever $x \neq y$, then $f(x)$ necessarily has the form $ax^{p^j} + b$. In this talk, I will discuss some extensions of this result and their applications.